FAILURE MODES EFFECTS ANALYSIS (FMEA) -- CIL HARDWARE
NUMBER: 03-1-0722 -X

SUBSYSTEM NAME: MAIN PROPULSION

REVISION: 1 02/20/01

PART DATA

	PART NAME / **VENDOR NAME**	**PART NUMBER** / **VENDOR NUMBER**
LRU	:TRANSDUCER, LO2 PRESSURE	ME449-0179-0173
	GOULD-MSD	PA8105-300-22131

EXTENDED DESCRIPTION OF PART UNDER ANALYSIS:
TRANSDUCER, LO2 ENGINE INLET PRESSURE

REFERENCE DESIGNATORS: V41P1130C
V41P1230C
V41P1330C

QUANTITY OF LIKE ITEMS: 3
ONE PER ENGINE

FUNCTION:
MEASURES LO2 ENGINE FEEDLINE PRESSURE NEAR THE ENGINE INLET. PRESSURE DATA IS USED FOR POST FLIGHT DATA ANALYSIS.

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NUMBER: 03-1-0722-02

REVISION#: 1 10/30/01

SUBSYSTEM NAME: MAIN PROPULSION
LRU: TRANSDUCER, LO2 PRESSURE
ITEM NAME: TRANSDUCER, LO2 PRESSURE

CRITICALITY OF THIS FAILURE MODE: 1/1

FAILURE MODE:
RUPTURE/LEAKAGE

MISSION PHASE:
PL PRE-LAUNCH
LO LIFT-OFF

VEHICLE/PAYLOAD/KIT EFFECTIVITY:
102 COLUMBIA
103 DISCOVERY
104 ATLANTIS
105 ENDEAVOUR

CAUSE:
FATIGUE, MATERIAL DEFECT

CRITICALITY 1/1 DURING INTACT ABORT ONLY? NO

REDUNDANCY SCREEN
A) N/A
B) N/A
C) N/A

PASS/FAIL RATIONALE:
A)

B)

C)

- FAILURE EFFECTS -

(A) SUBSYSTEM:
LO2 LEAKAGE INTO THE AFT COMPARTMENT. GN2 PURGE OF THE AFT COMPARTMENT MAY LOWER THE GO2 CONCENTRATION. POSSIBLE OVERPRESSURIZATION OF THE AFT COMPARTMENT. POSSIBLE LOSS OF ADJACENT CRITICAL FUNCTIONS DUE TO CRYO

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EXPOSURE. LEAKAGE DETECTABLE ON GROUND USING HAZARDOUS GAS DETECTION SYSTEM (HGDS).

ALSO RESULTS IN POSSIBLE LOSS OF HELIUM SUPPLY DURING MANIFOLD REPRESSURIZATION CAUSING LOSS OF AFT COMPARTMENT PURGE.

(B) INTERFACING SUBSYSTEM(S):
SAME AS A.

(C) MISSION:
ON GROUND, VIOLATION OF HGDS LCC WILL RESULT IN LAUNCH SCRUB.

(D) CREW, VEHICLE, AND ELEMENT(S):
POSSIBLE LOSS OF CREW/VEHICLE.

(E) FUNCTIONAL CRITICALITY EFFECTS:
NONE.

-DISPOSITION RATIONALE-

(A) DESIGN:
THE TRANSDUCER PRIMARY BARRIER UTILIZES WELDED INCONEL 718 COMPONENTS (THREADED FITTING AND DIAPHRAGM) AND IS DESIGNED FOR A PROOF PRESSURE OF 900 PSIA. A 304L CASE ASSEMBLY, INCLUDING FEEDTHROUGH TERMINALS, IS WELDED TO THE THREADED FITTING TO PROVIDE A SECONDARY BARRIER. THE SECONDARY BARRIER IS DESIGNED FOR A BURST PRESSURE OF 2000 PSIA. STRUCTURAL ANALYSIS INDICATES A POSITIVE MARGIN OF SAFETY FOR ALL OPERATING CONDITIONS.

THE CASE ASSEMBLY IS EVACUATED, THEN SEALED BY WELDING A BALL INTO THE LEAK CHECK PORT.

(B) TEST:
MANUFACTURING

THERMAL CYCLE
WITH POWER APPLIED, CYCLE BETWEEN -147 DEG F AND -297 DEG F SIX TIMES STAYING 2 HOURS AT EACH TEMPERATURE. DURING EACH 2 HOUR PERIOD, CYCLE PRESSURE FROM 0 TO 75 PERCENT MINIMUM OF FULL SCALE (FULL SCALE IS 0 TO 300 PSIA) TWICE EACH HOUR.

ATP

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EXAMINATION OF PRODUCT

PERFORMANCE TESTS

INSULATION RESISTANCE

CALIBRATION

0, 20, 40, 60, 80, 100, 80, 60, 40, 20 AND 0 PERCENT OF FULL SCALE PRESSURE AT -147 DEG F, -225 DEG F, AND -297 DEG F. RECORD ERROR DUE TO TEMPERATURE EFFECTS, LINEARITY, RESIDUAL IMBALANCE, REPEATABILITY, SENSITIVITY, AND VIBRATION.

CERTIFICATION

THE TRANSDUCER WAS CERTIFIED BY SIMILARITY, DESIGN ANALYSIS, AND TESTING, AND IS SIMILAR IN DESIGN AND CONSTRUCTION TO TRANSDUCERS CERTIFIED BY BELL AEROSYSTEMS, MCDONNELL DOUGLAS, GENERAL ELECTRIC, AND MARTIN MARIETTA. THE PREVIOUS TEST LIMITS EXCEEDED ORBITER SPECIFICATION REQUIREMENTS. OFF-LIMITS VIBRATION TESTING WAS SUCCESSFULLY PERFORMED WITH NASA DESIGN AND RELIABILITY CONCURRENCE ON AN ME449-0179-0173 TRANSDUCER AFTER REDESIGN FOR THE HIGHER VIBRATION ENVIRONMENT EXPERIENCED BY SOME MPS PRESSURE TRANSDUCERS.

A QUALIFICATION UNIT WAS TESTED TO 2,000 PSI WITHOUT RUPTURING OR LEAKING. THE SECONDARY BARRIER WAS TESTED TO 30,000 PSI WITHOUT RUPTURING OR LEAKING.

OMRSD
ANY TURNAROUND CHECKOUT IS ACCOMPLISHED IN ACCORDANCE WITH OMRSD.

(C) INSPECTION:
RECEIVING INSPECTION
RECEIVING INSPECTION PERFORMS VISUAL AND DIMENSIONAL EXAMINATION OF ALL INCOMING PARTS. CERTIFICATION RECORDS/TEST REPORTS ARE MAINTAINED CERTIFYING MATERIALS AND PHYSICAL PROPERTIES. CORROSION PROTECTION FINISH IS CHECKED IN ACCORDANCE WITH REQUIREMENT.

CONTAMINATION CONTROL
INSPECTION VERIFIES REQUIRED PROCEDURES/SHOP PRACTICES ARE UTILIZED FOR CONTAMINATION CONTROL. CLEANLINESS LEVEL 800A IS MAINTAINED AND VERIFIED BY INSPECTION.

ASSEMBLY/INSTALLATION
PARTS ARE INSPECTED VISUALLY, DIMENSIONALLY AND INCREMENTALLY PER REQUIREMENTS. TOOL CALIBRATION IS VERIFIED BY INSPECTION. MANDATORY INSPECTION POINTS ARE INCLUDED IN ASSEMBLY PROCESS.

CRITICAL PROCESSES
WELDING IS MONITORED AND VERIFIED BY INSPECTION. SOLDERING, HEAT TREATING, AND PASSIVATING ARE ALSO VERIFIED BY INSPECTION.

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TESTING
ATP, INCLUDING PROOF PRESSURE TEST, IS OBSERVED AND VERIFIED BY INSPECTION.

HANDLING/PACKAGING
PACKAGING AND PROTECTION ARE VERIFIED BY INSPECTION TO APPLICABLE REQUIREMENTS. SPECIAL HANDLING PER DOCUMENTED INSTRUCTIONS IS VERIFIED, TO PRECLUDE DAMAGE, SHOCK, AND CONTAMINATION DURING COMPONENT HANDLING/TRANSPORTING/PACKAGING BETWEEN WORK STATIONS.

(D) FAILURE HISTORY:
CURRENT DATA ON TEST FAILURE, FLIGHT FAILURE, UNEXPLAINED ANOMALIES, AND OTHER FAILURES EXPERIENCED DURING GROUND PROCESSING ACTIVITY CAN BE FOUND IN THE PRACA DATABASE.

(E) OPERATIONAL USE:
FLIGHT: NO CREW ACTION CAN BE TAKEN.

GROUND: GROUND OPERATIONS SAFING PROCEDURES CONTAIN SAFING SEQUENCE OF EVENTS FOR MAJOR LEAKS IN THE OXYGEN SYSTEM.

- APPROVALS -

S&R ENGINEERING	: L. DANG	:/S/ L. DANG
S&R ENGINEERING ITM	: P. A. STENGER-NGUYEN	:/S/ P. A. STENGER-NGUYEN
DESIGN ENGINEERING	: HERB WOLFSON	:/S/ HERB WOLFSON
MPS SUBSYSTEM MGR.	: TIM REITH	:/S/ TIM REITH
INSTRUMENTATION	: BILL MCKEE	:/S/ BILL MCKEE
MOD	: JEFF MUSLER	:/S/ JEFF MUSLER
USA SAM	: MIKE SNYDER	:/S/ MIKE SNYDER
USA ORBITER ELEMENT	: SUZANNE LITTLE	:/S/ SUZANNE LITTLE
NASA SR&QA	: ERICH BASS	:/S/ ERICH BASS